THE ELIMINATION OF PILTDOWN MAN*

BY

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It is only in recent years that man has become inquisitive about his origin. From early times man was considered unique among all living things on our earth, which in its turn was considered the centre of the universe. With the advance of knowledge, disillusionment followed; for by the discovery that the sun and not the earth was the centre of the universe, Copernicus dealt the first blow to man's egocentricity. Who knows but that visits by spaceships to other planets may inflict a greater and even a more resounding shock?

In the middle of the eighteenth century, Linnaeus divided living things—plants and animals—into groups according to their characteristics and gave each two Latin names so that people of different languages had a common tongue in the field of this particular research. In addition to inventing the binary nomenclature Linnaeus claimed that man did not live in splendid isolation, but was a member of the Primate family! Here was "the unkindest cut of all" to the self-esteem of man, but Linnaeus lessened the insult by classifying man as Homo sapiens thus displaying an unconscious humour or an incurable optimism.

Exactly 100 years ago, the mutability of species was presented by Charles Darwin in his famous book "The Origin of Species through Natural Selection". About the same time, remains of the Neanderthal Man were discovered in a cave near Dusseldorf. These remains were thought to be of an ancestor of modern man. This view however was disbelieved and indeed strongly opposed by German Scientists including Virchow. Subsequently an extremely massive mandible of the Heidelberg man was discovered in Europe and, later in 1894, Pithecanthropus erectus was proclaimed and described by Eugene Dubois, a physician practising in the Dutch East Indies. There is no doubt that Dubois was greatly influenced by Darwin, and his own interest in anthropology led him to his discovery of this Java man. There was no more agreement among the Scientists regarding the importance of Pithecanthropus than there had been about the Neanderthaler and Virchow again led the dissenters.

So we find that at the beginning of the twentieth century extremely little material had been discovered that had any relevance to our enquiries and what there was, was so securely and jealously guarded even from experienced and international authorities, that an expert examination of the original fragments was almost impossible. However a start had been made in beginning to answer the self-imposed question—"Whence came man?"

From the writings of Thomas Huxley, a champion of Darwinism, we find that he considered that the difference in anatomy between man and the Anthropoids was less than that which separated the Anthropoids from the other apes. This, in the nineteenth century, caused an uproar especially among the clergy and the ecclesiastical Primate of all England himself led a furious attack in disputatious argument with Huxley. At this time it was still impossible to estimate the age of rock formation and so the calculation of age of the various fossil discoveries differed according to the personal calculation of each scientist.

There is no doubt that Darwin and Huxley stimulated the interest of all palaeontologists, geologists and anthropologists both professional and amateur. One of these was a Mr. Charles Dawson, a practicing solicitor who was also a very keen,

* Based on a Presidential Address to the Bristol Branch of the British Dental Association.

observant and not un-trained or un-skilled amateur geologist and anthropologist. He practiced at Uckfield in Sussex from 1890 and he became so successful that he obtained appointments as Clerk to the Magistrates, Clerk to the local Council and Steward of several Manors including that of Barkham Manor. This latter appointment occurred in 1898 and it is probable that it was at that time he first visited Barkham Manor at Piltdown near Fletching on his professional business. He was now 33 years of age and had achieved a mature success in his legal work, although his main interest seems to have been in archaeology. His success as an amateur can be deduced from the fact that he already was a Fellow of the Geological Society, Fellow of the Society of Antiquaries and he became a collector for the British Museum after he had presented his well known and documented collection of fossils. In his researches he discovered a source of natural gas which was used at Heathfield for illuminating public premises for many years. At other times he was occupied excavating at Hastings and the Lavant caves, unearthing fossils, identifying metal bearing strata, writing scientific communications and reading papers to various learned Societies. This avid and persistent search engaged Charles Dawson for over thirty years and yet his professional life was as busy as any man's and his law practice was never neglected. In fact it thrived so much that in 1905 he engaged a partner and thereafter was enabled to devote more time to his real love archaeology.

It must be remembered that at the beginning of the twentieth century communication was slow and travelling difficult and tedious so very careful planning was needed before any exploration could be attempted. So it is not surprising that Dawson's interest in the Piltdown gravel pit spread over a number of years. He records that he observed some flints among the gravel which was being used to repair a road near Piltdown Common and learned that they were excavated by workmen from a gravel-bed nearby. He examined the pit but found nothing of interest in it on that occasion but on a further visit, at some unspecified date, a workman gave him a small part of a thick human skull bone and in return no doubt received a suitable and to him more satisfactory token. Many years later (in 1911) in the same gravel pit he discovered another fragment, and the following summer several more, and in all nine skull fragments. A discovery of the greatest importance was apparent to Dawson and he immediately communicated the news to Dr. Arthur Smith Woodward of the British Museum, who examined the collection of fossils, human and animal, and reconstructed a skull from the human remains (Plate I). It was arranged between the two of them to keep the discovery secret until they could announce it to a scientific gathering of the Geological Society in London.

So in December 1912 at such a meeting Dawson and Smith Woodward announced to a large audience the discovery of The Dawn Man. It has been observed how few prehistoric human remains there were that had much significance to the problem "Whence came man?" Here, however were exhibited sufficient fragments to reconstruct a skull together with the lower jaw. Dawson explained how he had found the fossils together with palaeoliths and eoliths in the gravel bed at Piltdown and recalled in detail the various strata from which these fossils derived. From the strata it was possible to estimate approximately the age of our primitive ancestor. It also was possible of course that some fossils may have been washed down into the different layers of gravel of which there were three, but it was thought that they represented the Early Ice Age or possibly earlier. Attention was then drawn to the man-made palaeoliths to show that this Piltdown man could make tools because both were buried together.

It was then left to Smith Woodward to present to the impatient and excited audience the animal and human fragments; to describe each in detail and to give his reasons for their identification. The animal fragments, chiefly teeth, he recognized as belonging to horse, deer and hippopotamus. The reconstruction of the skull from the nine pieces of cranial bone and a portion of mandible with two molar teeth *in situ*, was explained and the complete replica was exhibited. The skull was large, with a high

forehead and a cranial capacity of about 1,350 c.cm. The bony wall was very thick—about 10 m.m. As we know that the modern European has a cranial capacity very little larger, it can be appreciated how easily Piltdown man was accepted most readily as regards this characteristic feature but the mandible presented many objections. The fragment consisted of the side of a lower jaw extending from just in front of the first molar backwards but with the condyle missing. The first and second molar teeth were firmly in their sockets and the occlusal surfaces worn flat, which presupposes that the mandible must have been freely movable in more than one plane as in modern man. The lower border of the jaw went further forward although the chin itself was missing as was the canine tooth which would have been invaluable. As presented complete, this Dawn Man had a human cranium but an ape-like jaw. This combination coincided with Darwin's prediction and what the anthropologists were convinced would be discovered.

Professor Waterston refused to his dying day to believe that the two came from the same creature and suggested that the jaw was that of a chimpanzee. There were the flat molars however and no monkeys or apes had worn molars such as these. There was almost universal agreement about the Piltdown Man and Dawson was honoured when it was named Eoanthropus Dawsoni. There was just one thing that Professor Arthur Keith, who at that time was Conservator at the Royal College of Surgeons, did not accept and that was the interpretation of the canine tooth. Professor Elliott Smith, an eminent authority on the brain, after careful examination of the brain cast declared it human and slightly larger than the reconstruction. Keith differed from both Elliott Smith and Smith Woodward in their reconstruction of the cranium and spent valuable time in argument.

In 1913 Father Teilhard a French Priest working with Dawson found a lower canine tooth in the same gravel bed at Piltdown and it corresponded almost exactly with the reconstructed one Smith Woodward had designed previously. Dr. A. S. Underwood took X-rays of the canine and the picture showed that great wear had taken place on the crown, so much so that the pulp had laid down secondary dentine and receded. One curious feature was the pulp canal wide open at the apex of the root. Mr. C. Lyne, a dental surgeon, in a paper he read at the Royal Society of Medicine pointed out that to bear the mark of such attrition the animal must be mature but the tooth was young as witness the wide open root apex. Underwood who was a well known dental anatomist forcefully and scornfully opposed this view and his interpretation was accepted by Keith unfortunately as well as by other experts.

If this were not enough, further evidence of antiquity was forthcoming as in 1914 a fossil bony club was found by Dawson at the original site and the following year 1915 he unearthed a molar tooth and part of a cranial bone at Sheffield Park a few miles from Piltdown. This was accepted as the second Piltdown Man. Organized digging took place in 1916 but Dawson took no part as he was suffering a disease to which he succumbed later that year. Nothing further was discovered but already there was a sufficiency to establish this primitive man as Darwin's "missing link". Not that there was unanimous agreement even at that time—far from it. Furious argument and dissension raged among the scientists. Some subscribed to the monistic view that the cranium and the mandible belonged to the same creature; others to the dualistic belief of the human cranium and the ape's jaw, while a few were irreconcilable. The British public took no interest in the matter for it was by then engaged in World War I.

After the war was over, search was made in various parts of the world for evidence of prehistoric man. Energy and perspicuity were rewarded when the second Java Man was discovered, the Solo Man and in China, the Pekin Man. In South Africa too, many specimens were discovered notably the Rhodesian Man. The striking thing about all these later discoveries was that they possessed simian characteristics in every way except the jaw and teeth, which were similar to those of modern man. This appearance would be the complete reversal of the human-like cranium and

ape-like jaw of Piltdown. Piltdown Man was alone, the odd man out. The parallel theory was now evoked to suggest that two distinct forms developed simultaneously and there was confusion as to which was the ancestor of Homo sapiens.

In 1948 Dr. Kenneth Oakley of the British Museum described a method by which the age of a bone could be ascertained according to the amount of fluorine it contained. The amount of fluorine absorbed into the chemical structure depended upon the time the bone remained buried in the earth. In subsequent years he applied the fluorine test to the Piltdown bones and estimated that they were not nearly so old as had been believed, and immediately refuting what Sir Arthur Keith had written—"Piltdown Man represents the earliest specimen of humanity yet discovered". It is worth while recording that Mr. Alvan Marston, a Dental Surgeon, had long maintained that the jaw was simian and the mandibular right canine tooth was in fact a left maxillary canine belonging to an Orang-utan!!

Thus Eoanthropus seemed to have become an impossibility or so thought Dr. J. S. Weiner, an anthropologist at Oxford University. If the jaw had been treated to make it appear older than it was, perhaps the teeth had received treatment too and recently at that. He imparted his thoughts to Professor le Gros Clark who supported him in his effort to solve the apparent paradox. They re-examined the casts and with Dr. Oakley were permitted to examine the originals at the British Museum. Artificial scratches were observed on the occlusal surfaces of the molar and also on the canine and suspicion of fraud became so great that it was not difficult to obtain permission to subject Piltdown Man to a bombardment of comprehensive scientific tests. Dr. Oakley sought the aid of his colleagues, all expert in their own particular fields of research, and detection began.

The fluorine test showed that the skull bones were considerably older than the mandible so that the cranium and jaw belonged to two different beings. With increasing age while the fluorine in fossil bone increases, the nitrogen content decreases. With this test however the jaw and teeth contained a high nitrogen content and the cranial fragments a little. (It should be mentioned that some authorities do not accept this as conclusive evidence because Dr. A. J. Clement has stated that the organic matter in Homo rhodesiensis is unchanged.) The possibility of forging a portion of mandible with two molar teeth *in situ* became a probability when the right side of an orang-utan mandible was broken to the same dimensions and the occlusal surfaces of the molars ground flat as exhibited in the Piltdown specimen (Plate II). A canine tooth of an orang-utan was similarly abraded to simulate the attrition shown in the Piltdown tooth (Plate III). Suitably stained the comparative specimens evinced a striking resemblance. The brown staining of the specimens proved to be artificial especially in the canine where it was very superficial. The teeth had been artificially abraded to simulate natural wear and the canine so excessively as to expose the pulp chamber, the exposure being plugged by a plastic material. This was demonstrated clearly by X-ray pictures as was the wide open root apex and the loose sandy particles in the pulp canal. The occlusal surfaces of the molars were not in the same plane as one would expect. Samples of powdered bone were examined by X-ray crystallography and even the electron microscopes and the Geiger counter were brought into action.

The results of all the exhaustive tests convinced everyone that Piltdown Man was ill-gotten, and had been deliberately foisted on and accepted by most of the expert scientists. The bitter truth was revealed that Piltdown Man was a forgery. The extraordinary thickness of the skull bone had not been explained but it has been suggested as pathological. In any case negroes in Dutch Guiana possess equally thick skulls.

Who perpetrated this gigantic fraud with such care and patience? It must have been someone with sufficient specialised knowledge. He must have had the capacity and the opportunity and certainly possessed a strong enough motive. From all accounts Dawson was not at all a popular man in Sussex archaeological circles and no doubt had many enemies, possibly through jealousy of his discoveries. One of

PLATE I

By permission of the British Museum (Natural History)

The Dawn Man of Sussex—Eoanthropus dawsoni.
(*A composite reconstruction of brain-case and jaw.*)

[*Face page 4*

PLATE II

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The inner aspect of the Piltdown mandible (lower) is shown for comparison with a mandible from a female orang-utan (upper); the upper specimen has been broken and the teeth abraded to simulate the Piltdown specimen. (Prepared by L. E. Parsons)

PLATE III

The cast of the Piltdown canine (left) is compared with a canine from a rather more mature orang; the latter tooth has been stained and abraded to simulate the Piltdown specimen.

By permission of the British Museum (Natural History)

these may have sought revenge for some considered slight by planting the forgeries in the gravel bed where Dawson would find them. To be able to do so on so many occasions and over a period of years without discovery he would indeed be lucky. However improbable this may be, it is a possible explanation and maybe a charitable one. Dawson is known to have stained certain fragments with dichromate to harden them, as he explained. If he were not the culprit he certainly assisted in the forgery by this action. Smith Woodward and Teilhard are completely above the slightest suspicion as they had no part in and even were not available during most of the discoveries. They were men of the highest integrity. This circumstantial evidence is not conclusive proof that Dawson was the guilty person, but clearly suspicion invests him with a large measure of responsibility. It may well be that the most culpable were the eminent scientists who so eagerly accepted Piltdown Man as an answer to their preconceived ideas without the critical and stringent analyses of which they were capable.

In the headquarters of the Geological Society in London there was a painting depicting those most associated with the discovery and identification of Piltdown Man. It was painted in 1915 and shows Professor Arthur Keith examining the skull while Professor Elliott Smith is drawing attention to a certain detail. Half a dozen others are grouped around with Dawson and Smith Woodward prominent and in the distance a portrait of Charles Darwin hangs on the wall. Maybe this painting does not occupy such an honoured position today.

The energy expanded over forty years by scientists on Piltdown Man might have been employed more profitably in the pursuit of their knowledge of legitimate ancestors. Although we are a long way from understanding how man came to his present state, anthropologists and palaeontologists must be greatly relieved that Piltdown Man has been eliminated from their researches and this enigma, as Keith called him, banished from serious consideration.

ACKNOWLEDGMENTS

I wish to thank Professor J. S. Weiner for his ready kindness in allowing me to reproduce the illustrations of the composite reconstruction of brain-case and jaw of Piltdown Man and the canine teeth compared, as published by Oxford University Press, London, in his book "The Piltdown Forgery". I also am grateful that the illustrations of the Piltdown and Orang-utan mandible are included: "By permission of the British Museum (Natural History)", and by courtesy of the Trustees.

REFERENCES

Clement, A. J. (1958). *Brit. dent. J.*
Keith, Sir Arthur. (1925). *The Antiquity of Man.* Williams and Norgate, London.
Lyne, C. W. (1916). Significance of the Radiographs of Piltdown Man. *Proc. Roy. Soc. Med.*
Underwood, A. S. (1913). "The Piltdown Skull" *Brit. J. Dent. Sci.*
Von Koenigswald, G. H. R. (1956). *Meeting Prehistoric Man.* Thames and Hudson, London.
Oakley, K. P. (1948). Fluorine and the Relative Dating of Bones. Advancement of Science, **16.**
Weiner, J. S. (1955). *The Piltdown Forgery.* Oxford University Press, London.
Weiner, J. S., Oakley, K. P. and Le Gros Clark, W. E. (1953). "The solution of the Piltdown Problem" *Bull. Brit. Mus.* (*Nat. Hist.*) *Geol.*

RECENT DEVELOPMENTS IN CARDIAC SURGERY

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The scope of cardiac surgery is continually changing. Operations such as those for mitral stenosis, patent ductus arteriosus and coarctation of the aorta are now well established. These cases rarely require special investigation and have passed into the routine list of any general surgeon who is familiar with the conduct of thoracotomy and its complications. Other operations are made possible by the use of hypothermia, and a further group remains in which successful results will be achieved after a safe extra-corporal circulation has been perfected. Up to the present, too few cases requiring surgery under hypothermia have been referred to us for treatment; in selecting cases for surgery it must be remembered that the presence of advanced cardiac pathology or cardiac failure considerably adds to the mortality and now that hypothermia carries very little risk, it is unwise to with-hold surgery until signs of heart strain appear. When the experimental work on cardiac by-pass has been completed the same principle will apply if the work is to be carried out in patients with any hope of success.

DIAGNOSIS

Exact preoperative diagnosis is imperative for safe cardiac surgery. In addition to routine procedures such as radiography and electrocardiography it may be necessary to perform cardiac catheterisation and cine radiography after injecting radio-opaque dye into the right ventricle. In acquired abnormalities of the mitral valve in which the exact functional abnormality is in doubt the left atrium may be punctured for pressure recording through a bronchoscope introduced into the left bronchus. This technique was introduced by Allison and was subsequently developed in the United States. It is possible to thread a fine nylon tube through the needle in the left bronchus and this tube is fed into the left ventricle and aorta. Pressure readings taking across the aortic and mitral valves give an indication of their function which is valuable in some cases.

Surgical treatment may now be classified under three main headings:

(1) Operations which can be performed under standard conditions.
(2) Operations which require hypothermia.
(3) Operations which can only be performed with cardiopulmonary by-pass or the heart lung machine.

OPERATIONS UNDER HYPOTHERMIA

Animal experiments in hypothermia were begun in Bristol in 1954 with a view to correcting atrial septal defects in man. At this time skin cooling was employed using refrigerated glycol circulating in rubber tubes packed into blankets. This method was successfully used to make atrial septal defects in animals but the time taken to cool the animals was very great (Fig. 1). Other workers found that immersion in a cold or iced bath achieved quicker cooling. In this method the animal gets a blanket of warmer water adjacent to him which insulates him from the cold water of the bath. It was found that circulating water prevented this insulating effect and more rapid cooling or

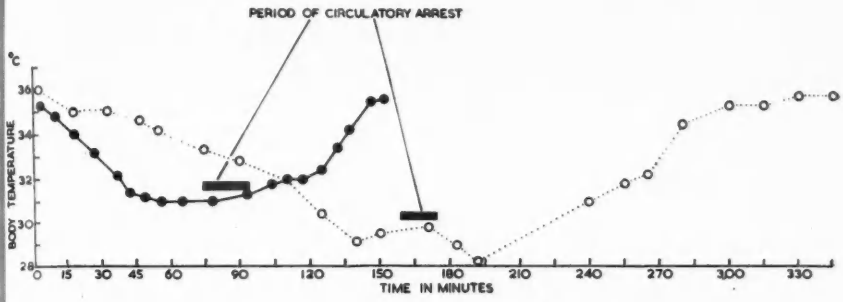

FIG. 1. *Cooling curves.*

. . . Small dog cooled by original technique of circulating glycol at 3° C through a blanket containing rubber tubing. Atrial septal defect created, with recovery of the animal (1954).

——Adult patient cooled for carotid embolectomy using immersion in running tap water and later control with plastic blanket as described in text.

warming was possible (Fig. 2). Some further cooling takes place when the patient is taken out of the cold bath as a result of circulation of blood through cold skin. This "after cooling" can be limited to about 1°–2° C by placing the patient on a water blanket through which water is pumped at 40° C (Plate IV). By varying the temperature of the circulating water considerable control of the patients temperature is possible.

Hypothermia permits total arrest of the circulation for periods up to 10 minutes at 29° C and we have used this for a variety of cases. Temperatures below 28° C carry a risk of ventricular fibrillation. In addition we have used moderate hypothermia (31° C) in some poor risk cardiac cases such as severe mitral stenosis and tricuspid atresia.

During surgery we believe continuous electrocardiography to be essential and during the period of circulatory arrest and subsequent recovery electro-encephalography is routinely used. The electro-encephalogram gives information regarding the adequacy of the cerebral circulation and during periods of cardiac arrest it is used to assess the effectiveness of the surgeon's cardiac massage (Plate IV).

CARDIOPULMONARY BY-PASS

The development of successful "heart-lung" machines in the U.S.A., stimulated us to begin work on this problem about 3 years ago. The problem is to extract blood from the cavae, to oxygenate this blood and to return it at a reasonable pressure and flow rate to the ascending aorta. The pump side of the problem is not great and most machines have foundered on failure of the oxygenator. Oxygenation and removal of carbon dioxide from blood does not present a difficult problem in itself but it must be done without damaging the blood, defibrinating it, or introducing microscopic sized bubbles. About three years ago a team consisting of Dr. Barratt-Boyes and Mr. Wilson, in addition to the authors began to study this problem and the full results of this work will shortly be published. Briefly we tried to use heterologous lungs, taken from an animal killed at the time of the experiment. In fact goats lungs were most commonly used as oxygenator to by-pass the heart and lungs of a calf. The calf proved a difficult experimental animal but some success was achieved and there were some survivors.

However, the technique presented many difficulties and work in the Departments of Surgery and Anaesthetics is now directed to the design of a satisfactory oxygenator. There can be little doubt that this problem will be mastered and direct surgery of the ventricles and valves of the heart will then be possible.

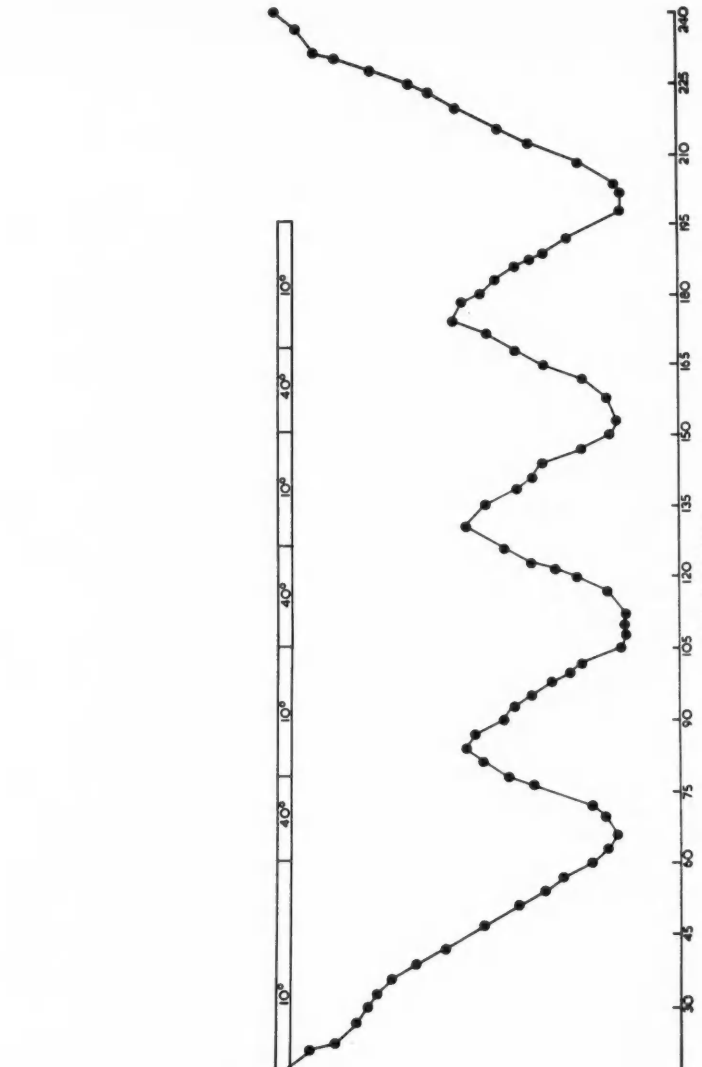

FIG. 2. *Experiment to show the ready control of temperature which can be obtained by changes in the ambient temperture of circulating water. In this experiment the animal was a fully grown unshaved goat.*

MITRAL STENOSIS

No special investigations are required in cases of mitral stenosis unless there is a combined cardiac and pulmonary disability. In such cases cardiac catheterisation may be advisable as a method of estimating left atrial pressure. Bronchoscopic catheterisation of the left atrium gives a direct left atrial pressure reading and if the diagnosis of mitral incompetence is in question pressure tracings across the mitral valve may be helpful. If the mitral valve restenoses after valvotomy it is best treated by a transventricular operation using a mechanical dilator, and in fact recent experience suggests that much better results can be achieved by the use of a dilator when the valve resists digital commissurotomy.

So far the relief of mitral incompetence has eluded surgeons but treatment may be possible when the heart-lung machine has been perfected.

PATENT DUCTUS ARTERIOSUS

It is now nearly 20 years since the first ligation of a patent ductus arteriosus (Gross 1939, Keele and Tubbs 1940). The operation is now well established and it is generally accepted that a patent ductus should always be closed surgically. In a few cases cardiac enlargement or failure takes place in early infancy and such an event demands early intervention. The youngest case in our series was a baby of 10 weeks who was in obvious cardiac failure and a number of other babies with cardiomegaly have had the ductus closed before the age of 2 years. Most cases are diagnosed at 5 years by the physician making a routine school examination. These cases are asymptomatic but they should be treated surgically without delay. It is absolutely unjustifiable to wait in the hope that spontaneous closure will take place after the age of 5 years. Although this faint possibility exists it is far outweighed by the increasing risk of surgery in older children and adults.

Many physicians have records of occasional patients with patent ductus arteriosus who have survived to the age of 50 or more but deterioration is likely in the 3rd or 4th decades and safe surgery can only be offered in childhood. Irene Cade reported the first 50 patients treated in the Department of Surgery at Bristol in 1954; the number now exceeds 100 without mortality. Most cases are still treated by triple ligation but when the ductus is large division between Potts' clamps is preferred.

COARCTATION OF THE AORTA

In this condition too, the main principles of surgery have been established. The natural history has been reviewed by Campbell and Baylis; the blood pressure rises steadily to an average figure of 190-105 at 17 years and there is a risk of sudden fatality during the 3rd decade. Few of those who survive to 40 years remain asymptomatic.

The case for resection of a coarctation about the age of 7 to 8 years is a strong one. At this age the operation can be completed with comparative ease and safety. The aorta is healthy and holds sutures well. Later it becomes atheromatous and after the age of 15 years the operation carries a much greater hazard though it is still well worth while. In a review of cases treated in the Department of Surgery, Bristol, and also in Manchester, Milnes Walker and Haxton (1954) noted a considerable drop in blood pressure after resection though it often took some months for the full effect to take place. There is a tendency for an aneurysm to form below the coarctation and in the older patients it may be necessary to resect a considerable length of aorta. For this reason an operation for coarctation should never be undertaken unless an arterial graft is available.

There has recently been a plea for surgical intervention in infants with coarctation and heart failure. It is doubtful if this course is the right one. Careful nursing and digitalis may pull an infant through a difficult first few months of life. Surgery at best can give a suture line which is the size of the aorta in infancy and if the scar does not

stretch a considerable narrowing will develop as growth takes place. It is also impossible at present to determine that the heart failure is not due to co-existing fibroelastosis.

PULMONARY STENOSIS

Pulmonary stenosis occurs as part of the abnormality referred to as the tetralogy of Fallot. In this section reference is made only to what is commonly designated pure pulmonary stenosis. This is in fact poor terminology, for an associated atrial septal defect is common.

Stenosis of the pulmonary valve varies in degree but always results in hypertrophy of the right ventricle and a pressure gradient across the pulmonary valve. Eventually the right ventricle shows signs of strain and failure and if an atrial septal defect is present blood will be shunted from right to left and cause cyanosis. An important bundle of heart muscle, the crista supraventricularis, takes part in the general hypertrophy of the right ventricle and this may eventually be so great that in systole the infundibulum of the right ventricle is almost completely occluded. This can be clearly shown by cine radiography. Brock (1957b) has called attention to this infundibular obstruction and describes the heart as "muscle-bound". Valvotomy at this stage may not relieve the obstruction to the right ventricle and we have experience of two patients who died after satisfactory valvotomy from failure of the right ventricle. Kirklin (1953) has called attention to the fact that a fall in right ventricular pressure may take place gradually after valvotomy and suggests this is due to regression of myocardial hypertrophy. If patients are left until secondary obstruction to the infundibulum has taken place the opportunity for safe relief of pulmonary stenosis by any route has been lost. The crista supraventricularis could be resected through the pulmonary valve after valvotomy but the effect of division of such an important muscle bundle may be serious.

It is our present practice to operate under hypothermia. An excellent view of the valve is obtained and complete division of the valve to the valve ring is possible, with about 5 minutes of circulatory arrest. Figure 3 and Plate V show the hypothermia chart and incision in a patient referred by Dr. Apley. Recently we have been doing this operation through a vertical sternotomy. Access is excellent and the post operative course is smoother because both pleural cavities are intact.

ATRIAL SEPTAL DEFECT

There are three main anatomical types of atrial septal defect (Fig 4).

(*i*) *Persistent ostium primum defect*

In this type of defect the lower edge is continuous with the atrioventricular valve ring. Closure of such a defect by direct suture would result in serious interference with function of the valves and must be avoided. This type of defect is often associated with disability and enlargement of the heart in childhood. Other signs may include left ventricular hypertrophy or heart block.

A more serious variety of this anomaly is the persistent atrioventricular canal in which a ventricular septal defect is also present and may be continuous through the valve ring with the atrial septal defect. Some of these patients are mongols.

Treatment presents a serious problem at present. Simple suture under hypothermia is contraindicated and it will probably be necessary to insert a prosthesis of polyvinyl alcohol sponge with the heart isolated and circulation maintained with the heart-lung machine.

(*ii*) *Persistent ostium secundum* (*fossa-ovalis defect*)

The essential feature of this defect is a clear margin of septum between the defect and the atrioventricular valve ring. Secundum defects vary somewhat in size and may be fenestrated. When the defect is small patients remain symptomless for many years. In many cases however deterioration takes place in the 3rd and 4th decades. When this happens the time for safe surgery has passed and Bedford, Kirklin, Swan and others

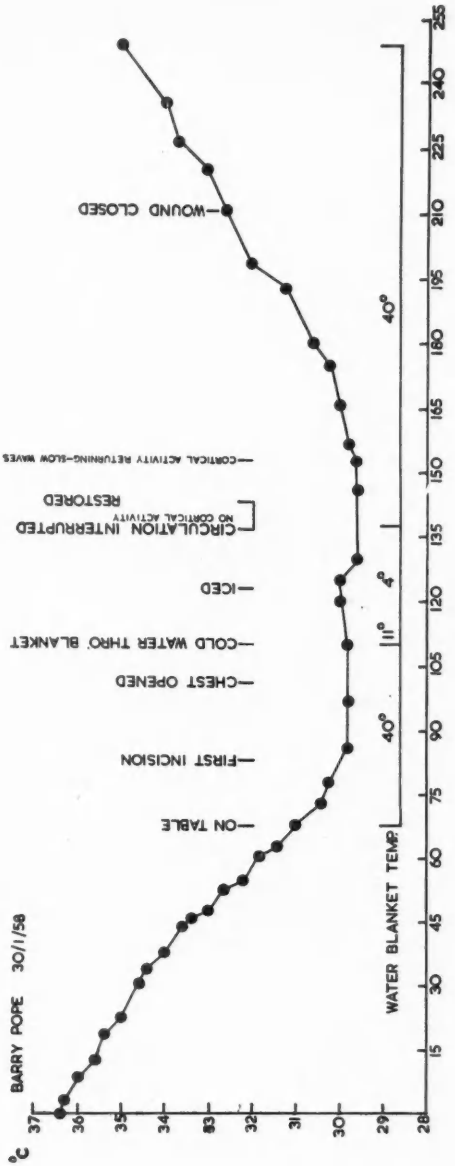

FIG. 3. *Hypothermia chart in a patient operated on for pulmonary stenosis. Note the way in which the patient's temperature was lowered about one degree just before the period of circulatory arrest by circulating cold water through the blanket.*

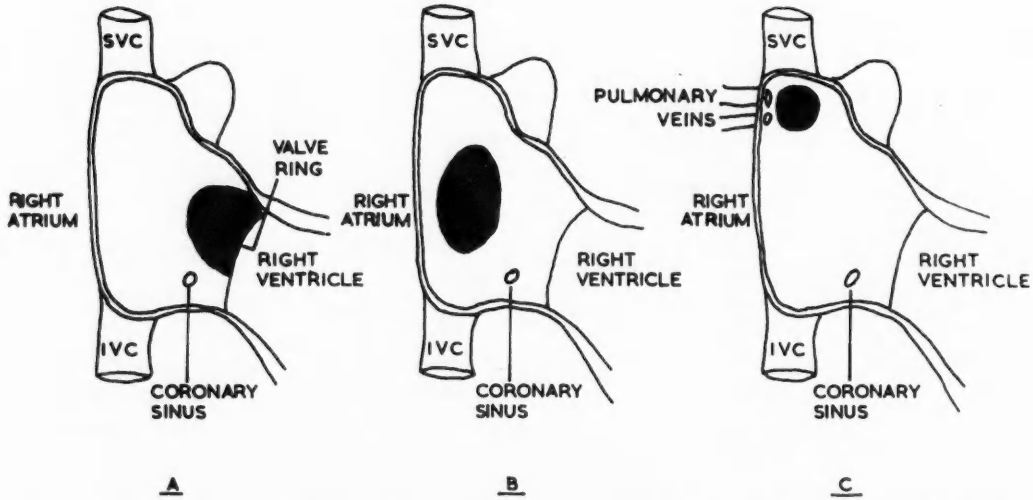

FIG. 4. *Anatomical types of Atrial Septal Defect. A. Septum primum defect. B. Secundum defect. C. High defect with anomalous venous return.*

PLATE IV

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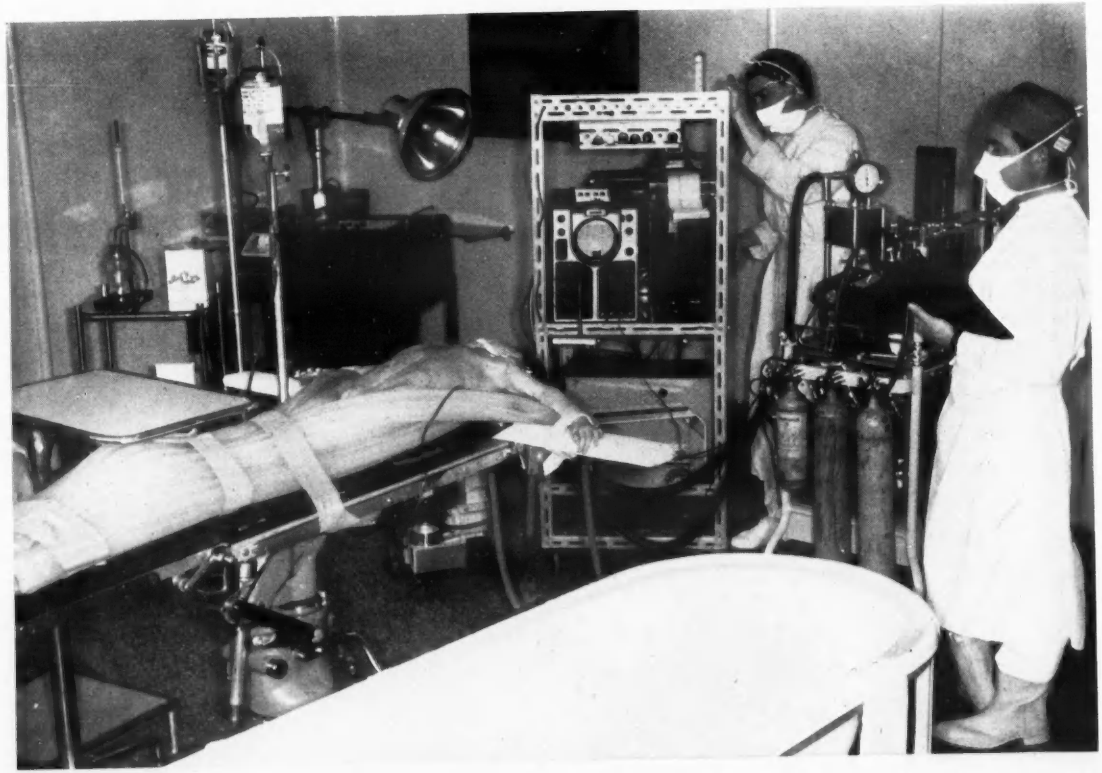
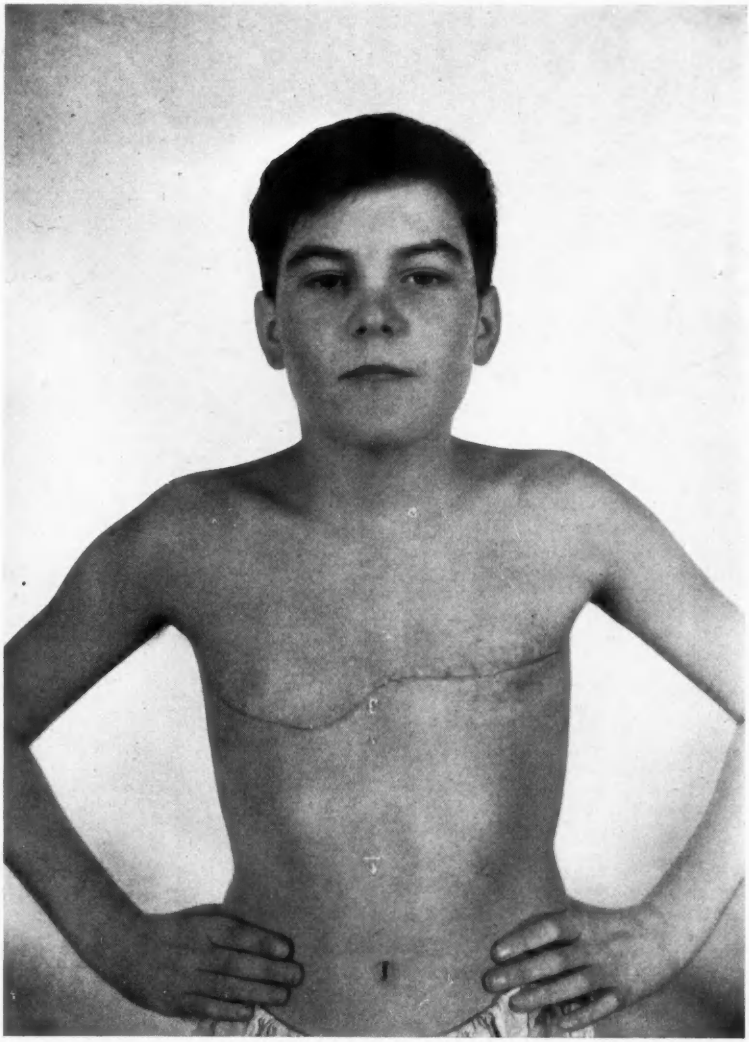


General view of operating room during hypothermia. In addition to bath and water blanket the picture shows from left to right, electrical manometer, electrocardiograph and electroencephalograph, anaesthetic apparatus and thermistor thermometer.

PLATE V



Bilateral thoracotomy incision used for major cardiotomy. This patient had pulmonary valve stenosis. He was treated by direct vision valvotomy under hypothermia.

PLATE VI

Myxoma removed from left atrium.

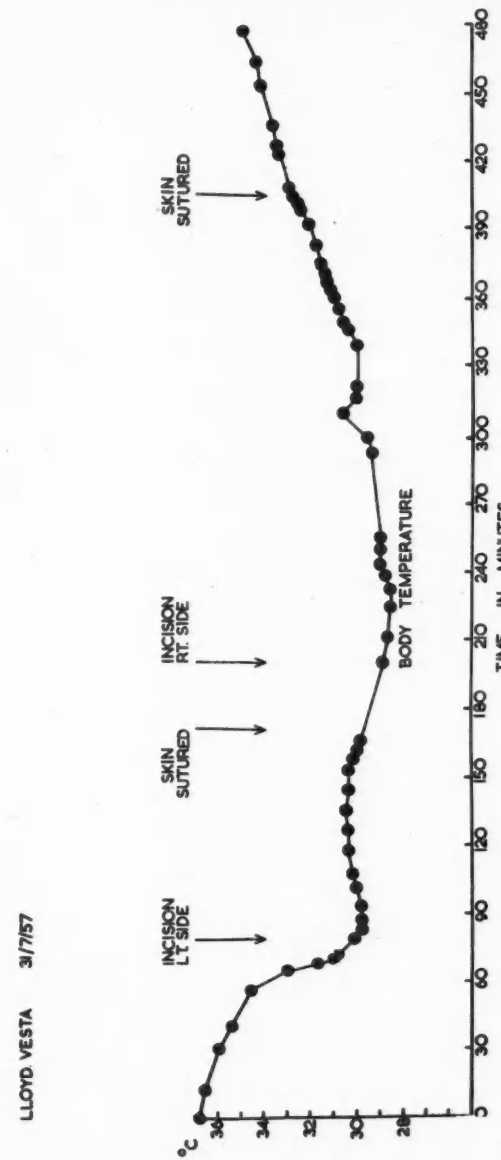


FIG. 5. *Hypothermia chart in a case of myxoma of the left atrium.*

(1957) believe that all uncomplicated cases of atrial septal defect of this type should be operated on before the age of 20 years. Now that hypothermia carries such slight intrinsic risk there can be little doubt as to the logic of this even though most of the patients will be symptom free at the time of surgery.

(*iii*) In the third type the defect is above the foramen ovale and lies immediately below the superior vena cava. Associated anomalous vanous return is commonly seen in this group; i.e. one or more pulmonary veins drain into the right atrium.

These defects can be closed under direct vision using hypothermia but care must be taken to close the defect in front of the pulmonary vein openings and it may eventually prove better to operate on this type of defect with cardiac by-pass.

INTRA-CARDIAC TUMOURS

A variety of intracardiac tumours have been described but of these the myxoma is most common and of greatest surgical importance. This is a polypoid tumour which generally arises in the left atrium and causes obstruction to the circulation by obstructing the mitral valve. During periods of exercise the increased blood flow may sweep the tumour into the mitral orifice plugging it and causing total arrest of the circulation and temporary syncope. Most cases are diagnosed as mitral stenosis without a mitral murmur. Only one successful operation has so far been recorded from this country and that in a man of 25 years who had a four months history of cardiac illness (Chin and Ross 1957). The approach to a myxoma of the left atrium is through the right atrium and the atrial septum. A direct approach through the left atrium is almost certainly doomed to failure because of the entry of air into the left side of the heart and so into the coronary circulation.

In one patient operated on at the Bristol Royal Infirmary the diagnosis was strongly suspected before cardiotomy. This was a woman of 55 years referred by Dr. Sutton who had been diagnosed as having mitral stenosis for some years and had been practically bed-ridden with cardiac failure for about a year. There were no murmurs but clinical and catheter evidence of severe pulmonary hypertension. The mitral valve was explored in the usual way but under hypothermia (Fig. 5). The valve was normal and the myxoma was identified arising from the atrial septum just above the mitral valve. The incision was closed, the position changed and a bilateral thoracotomy done. The circulation was controlled in the usual way and the right atrium opened; the atrial septum was incised and the tumour removed from the left atrium (Plate VI). The septum was closed and the atrium clamped. Circulatory arrest was for 10 minutes. The circulation was slow in becoming properly re-established but with the assistance of cardiac massage a normal electroencephalogram was obtained and consciousness restored. Unfortunately she died about 18 hours after the operation.

AORTIC STENOSIS

Considerable series of cases of both congenital and acquired aortic stenosis have been published. Marquis and Logan (1955) have called attention to the fact that in congenital cases sudden death may occur without previous dyspnoea on exertion. Of six of their patients operated on by the transventricular route aortic incompetence was produced in four. As aortic incompetence is a more damaging lesion than aortic stenosis these results must give cause for anxiety. We have operated on two patients with congenital aortic stenosis. One is greatly improved clinically and the systolic pressure is 10 mm Hg higher but a faint diastolic murmur is now present, some two years after the operation. The other is too recent for assessment but has a 30 mm rise in systolic blood pressure.

No case of acquired aortic stenosis has been referred for surgical treatment though Brock (1957a) has reported results of 130 operations with a good result in 70 per cent of the survivors. In assessing the indication he suggests a pressure gradient of more than 50 mm. Hg. as shown by left ventricle and brachial artery puncture. Two

operative routes are available. The transventricular route carries the disadvantages that there is a high incidence of ventricular fibrillation and that the operation is blind. Serious aortic incompetence has undoubtedly been caused in some cases and Lillehei (1957) comments that most surgeons cannot hide some disappointment over the results.

In one patient who died in hospital with severe aortic stenosis while under medical treatment a post-mortem valvotomy was performed by the transventricular route. When the dilator was opened the valve was felt to give way but when it was inspected it was found that two cusps had given way but the adherent commissures had not been split. For these reasons the open transaortic view under hypothermia is favoured because the commissures could then be deliberately divided. Our second case of congenital aortic stenosis was treated this way. It is probable that the opening should be something less than a cut right out to the valve ring. There is a distinct difference in principle here from the operation on the pulmonary valve. The aortic valve has to hold a diastolic pressure some 10 times that exerted on the pulmonary valve and incompetence is much more easily produced. Indeed it is well known that in severe systemic hypertension a normal aortic valve is sometimes incompetent.

Congenital subaortic valvar stenosis is a more promising surgical problem which can be dealt with through the ascending aorta and the aortic valve. Such an obstruction can be relieved without damaging the aortic valve and without risk of incompetence. The operation can be done with hypothermia and circulatory arrest or using cardiac by-pass.

FALLOT'S TETRALOGY AND VENTRICULAR SEPTAL DEFECT

Since the work of Blalock, Potts and Brock, patients with Follat's Tetralogy have derived considerable benefit from indirect operations (e.g. subclavian-pulmonary or aortic pulmonary anastomosis) or blind direct operations. We have had experience of each of these techniques and there are some excellent long term results. But other cases are less satisfactory and with the development of the heart-lung machine it should be possible to close a ventricular septal defect and to overcome the pulmonary stenosis. Not all cases can be suitable for such a procedure however. In some cases the pulmonary artery is absent and in others so small that closure of a V.S.D. would be followed by right ventricular failure consequent on the circulatory obstruction in the pulmonary artery. It is likely that shunt operations will have a permanent place in the more severe types of this effect.

CONCLUSION

It has been the purpose of this article to give an account of the work which has been done in Bristol both in clinical and experimental cardiac surgery.

In 1954 when work on hypothermia began few other centres in this country had any experience of the technique and in none was the experience great. Since the technique has been standardised round about 1955 only one adult with an atrial septal defect has been referred for surgery. A considerable number of children have been seen in consultation but it has been considered that these had septum primum defects and were unsuitable for repair by this technique.

It has only been possible in such a brief review to mention our current views on a few of these problems. It has not been possible to discuss more complicated disorders such as those of total and partial anomalous venous return, transposition of the great vessels, tricuspid atresia and related defects.

Finally it should be emphasised that intracardiac surgery can only be successful if it is the work of a team. Preoperative consultation between physician, surgeon and radiologist is essential. Co-operation at the time of operation and after it is no less important. It is because of this team work that such vast progress has been made in the past decade and there can be little doubt that a properly equipped centre with an

active cardiac team can still contribute much to our knowledge of cardiology and also to the relief of human suffering.

We wish to express our thanks to the physicians and radiologists who have co-operated in the development of cardiac surgery in Bristol. In addition we should like to thank Professor Messervy for his continued assistance with the provision of experimental facilities in the Surgical Department of the Veterinary School at Langford. Without his co-operation much of this work would never have been done. Finally we thank Professor Milnes Walker who has done so much for cardiovascular surgery in this country and who has helped and encouraged us throughout.

We are grateful to Mr. Badrick for technical help in the theatre and for drawing the graphs.

REFERENCES

1. Bedford, D. Evan, Sellors, T. Holmes, Somerville, W., Belcher, J. R., Besterman, E.M.M. (1957) *Lancet*, **1**, 1255.
2. Brock, R. C. (1957a) *Brit. Med. J.*, **1**, 1019.
3. Brock, R. C. (1957b) *The Anatomy of Congenital Pulmonary Stenosis*. Cassell, London.
4. Cade, Irene (1954) *Brit. J. Surg.*, **42**.
5. Campbell, M. and Baylis, J. H. (1956) **18**, 475.
6. Chin, E. F., Ross, D. N., (1957) *Brit. Med. J.* **1**, 1447.
7. Gross, R. E. (1939), *Ann. Surg.*, **110**, 321.
8. Keele, K. D. and Tubbs, O. S. (1940), *St. Bart's Hosp. J.*, **1**, 175.
9. Kirklin, J. W., Connelly, D. C., Ellis, F. H., Burchell, H. B., Edwards, J. E., Woods, E. H. (1953) *Circulation*, **8**, 849.
10. Kirklin, J. W., Weidman, W. H., Burroughs, J. T., Burchell, H. B., Wood, E. H. *Circulation* (1956), **13**, 825.
11. Lillehei, C. W., Paneth, M. (1957) *Ann. Rev. Med.*, **8**, 99.
12. Marquis, R. M., Logan, A. (1955) *Brit. Heart J.*, **17**, 373.
13. Swan, H., Blount, S. G., Virtue, R. W., (1955) *Surgery*, **38**, 858.
14. Walker, R. Milnes, H., (1954) *Brit. J. Surg.* **42**.

RECENT WORK ON THE DEMYELINATING DISEASES*

BY

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The outstanding problem in neurology during the last twenty to thirty years has been the cause of disseminated sclerosis. The solution may be a little nearer now and this review covers some of the developments during this period.

Just over twenty years ago J. R. M. Innes came to the National Hospital for Nervous Diseases and showed us some intriguing pictures of lambs with sway-back and suggested that here was a demyelinating disease which could be prevented by giving the ewes copper. Then, during the war, four workers studying sway-back developed themselves some curious symptoms resembling disseminated sclerosis. This naturally stimulated a considerable amount of work into the possible connection between copper—or other trace elements—and disseminated. To determine the normal ranges the copper levels in other patients in the neurological wards were examined. This was how the abnormal levels in Wilson's disease were found and the cause of this disorder accidentally established: to remind you—in Wilson's disease (hepatolenticular degeneration) it is suggested that excessive copper is absorbed from the intestine, perhaps by the failure of some mechanism which normally inhibits it. Then, instead of being converted within 24 hours to caeruloplasmin, it remains loosely attached to albumen and is therefore presumably free to be deposited in liver and basal ganglia. Chemical diagnosis depends on demonstrating a high copper excretion in the urine or, probably easier and more reliable, a low caeruloplasmin level in blood. We are now able to complete the picture by treating these patients with B.A.L. or penicillamide. The connection between Wilson's disease and sway-back is a tenuous one—there is too much copper in the one and too little in the other. There are also many problems in sway-back awaiting solution; the way it occurs on fields which have been heavily limed, the fact that unaffected ewes may have equally low blood copper, and the difficulty in correlating the pathological picture and clinical signs, are unexplained.

The next step in the story is work on the neurological complications of the exanthemata. It has long been recognized that the encephalomyelitides which occasionally complicate measles, chicken pox and rubella all look very similar. Originally it was suggested that these were a direct virus infection; then, when this proved unacceptable, it was suggested that the illness fanned into activity a virus lying dormant in the central nervous system, an explanation which seems much too ingenious to be true. It was then shown that a pathologically identical condition could be produced by the injection of sterile normal brain tissue together with an adjuvant consisting of killed tubercle bacilli; the substances which produce this change consist of a polysaccharide and polypeptide linked to mycolic acid. Some recent work has however suggested that several closely allied substances can produce the same effects. An interesting extension of this work has been the production of a similar pathological changes in the thyroid by the injection of thyroid tissue with an adjuvant, and in the same way changes have been produced in suprarenals and peripheral nerves.

On the clinical side it has been shown that although there is considerable variation in the latent periods of these neurological complications, the average latent period is shortest in the encephalitis group and longest in the polyradiculitis—in fact approximately double that for the encephalitides—and that this order holds true for each of

* Based on a communication to the West Country Physicians' Club, April 1958.

the diseases even though the average latent period varies between the different infections. This can be seen from Miller's figures (published in *Modern Trends in Neurology*, Williams, D. 1957):

Average latent period in days of neurological complications following measles, varicella and rubella.

	Measles	Varicella	Rubella
Encephalomyelitis	4·7	6·3	3·8
Myelitis	5·5	8·25	6·7
Polyradiculitis	9	11·25	8·7

Miller also brings into this group not only these complications of the exanthemata but also the isolated brachial plexus palsies after serum and T.A.B. innoculations; the neuralgic amyotrophy described by Parsonage and Turner (1948), acute haemorrhagic leuco-encephalitis and the neurological catastrophes that happen occasionally with anti-rabies treatment and prophylaxis. These cases are, however, comparatively rare and the work on them seems to have rather branched off from the main problem of the cause or mechanism of disseminated sclerosis. Even here there has perhaps been a little progress. Firstly a little more is known of the composition of myelin, it has been shown that there is an appreciable day to day turnover of myelin lipids. but the metabolism of myelin is obviously slow, perhaps connected with the slow evolution of the process in disseminated sclerosis. Sphingomyelin and cerebrosides appear during the first year of life and the biochemical development continues until sexual maturity. Thus while cerebroside values gradually increase, sphingomyelin, after the first few months, steadily decreases so that the cerebroside/sphingomyelin ratio rises throughout childhood and adolescence. It is interesting to speculate whether this could have any connection with the fact that disseminated so rarely, if ever, begins before adolescence.

The recent work on tissue culture is also interesting. Lumsden has shown that in tissue culture, cells particularly oligodendrocytes are not the static structures seen in stained preparations, but move and elongate and contract in a surprisingly mobile way and may well be intimately concerned with myelination. This work, however, has not yet had any practical application.

Returning to the question of allergy there has been an interesting observation published from Oxford. In the Oxford centre for tuberculous meningitis amongst the treatments used, is the injection of tuberculin into the C.S.F., and it has been shown that the response to this varies with the state of the Mantoux reaction. This response is remarkably consistent and once the result of the Mantoux test was known the character and intensity of the intrathecal response could be predicted with reasonable certainty. It could, however, be considerably modified by giving cortisone at the same time as the tuberculin. This led to the suggestion, that it might be beneficial to patients with disseminated sclerosis to be given intrathecal tuberculin; and it was found that the meninges in patients with disseminated sclerosis react differently from the normal—at least in the Mantoux positive group. In the Mantoux negative, as in the normal, no definite reaction was obtained. In the others, however, the response not only lacked consistency and regularity but was also different in character, being much nearer to that obtained when the normal is modified by cortisone. So it seems possible that the normal immunological processes must be disordered in some way—in fact the reaction could well be explained if one postulates that there is at work some substance with a cortisone-like effect.

It is interesting in this connection to speculate whether this could have any connection with the fact that even the most acute disseminated fails to make any response to cortisone whereas many of the acute encephalomyelitis cases react well to it.

Lastly, intrathecal tuberculin does seem to be beneficial to some patients with disseminated sclerosis. But we must accept this with caution, for even in the last twenty years there have been a good many different theories and treatments for disseminated sclerosis which have come and gone: venous thrombosis and vaccines, spherules, spirochaetes and diphtheroids, fever therapy and arsenic have all had their protagonists and although at the moment allergy or some disturbance in the antibody-antigen reaction seems to be in the ascendant, this is a long way from being proven; that is why this paper is entitled "recent work" and not "recent advances".

SELECTED REFERENCES

Greenfield, J. G., Blackwood, W., McMenemey, W. H., Meyer, A. and Norman, R. M. (1958). *Neuropathology*, London.

Lancet—leader on Wilson Disease. (1957). **1**, 976.

McAlpine, D., Compston, N. D. and Lumsden, C. E. (1955). *Multiple Sclerosis*. Edinburgh and London.

Miller, H. G., Stanton, J. B. and Gibbons, J. L. (1956). *Quart. J. Med.* **25**, 428.

Parsonage, M. J. and Turner, J. W. A. (1948). *Lancet* (1). 973.

Smith, Honor V., Espir, M. L. E., Whitty, C. W. M. and Russell, W. R. J. (1957). *Neurol. Neurosurg. Psychiat.* **20**, 1.

Williams, D. (1957). *Modern Trends in Neurology*. London, Second series.

PROLONGED COMA IN BARBITURATE POISONING

BY

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In 1954 the recorded deaths from barbiturate poisoning in England and Wales were 574 and non-fatal cases were assessed as 6,000 (Locket, 1956). In spite of the large number of reported cases in the literature, there were few in which coma was prolonged for more than a week. The *Medical Journal of Australia* (1934) mentioned a case of ten days' duration, McElligott (1955) cited another of ten days, Shulman *et al.* (1955) described one of twelve days, Rogerson (1955) reported an eleven-day coma and Lorraine (1954) reported a case with a ten-day coma treated with massive doses of strychnine.

Greater interest has been shown in barbiturate poisoning since β-methyl-β-ethyl glutarimide (Megimide) was introduced into therapy by Shaw (1954) and in the case of prolonged coma reported below this drug was used with apparent benefit.

CASE REPORT

A married woman of 46 was found unconscious in bed at 8.30 a.m. on the 31st May, 1957, having taken 7 grammes of phenobarbitone the day before. There was a previous history of depression, more marked recently and a previous attempt at suicide.

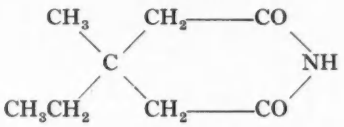
On admission she had shallow respirations, pulse 80/min., her blood pressure was 90/60, weak regular; there was peripheral cyanosis. She was unrousable with constricted pupils which reacted very sluggishly to light; the fundi were normal, and there was no neck stiffness. The corneal, pharyngeal and laryngeal reflexes were absent. The tracheal reflexes were present, the knee jerks were just elicited and the plantars responses were absent. There was some ulceration of the pharynx. There were moist sounds in all areas of the chest.

An endotracheal tube was passed immediately and Megimide 100 mgm. and Daptazole 30 mgm.I.V. were given at once with considerable increase in the depth of respiration. The patient remained comatose with fairly good respiratory function for another 36 hours when the airway became obstructed with oedema of the larynx, and her respiration became impaired. This necessitated emergency tracheotomy, and she was given Noradrenalin transfusion and a further 100 mgm. Megimide. This treatment produced some twitching of the muscles but no actual convulsion. Her respiration improved and blood pressure, which had fallen to 85/50, rose to 100/70. A lumbar puncture was carried out, which showed the pressure to be normal, C.S.F. containing two cells and 75 mgm protein. The patient remained unconscious until 6th June, 1957 when she began to move her head slightly, the peripheral reflexes became brisker and the corneal reflexes returned. Her blood pressure rose to 120/80 and a slight withdrawal-reflex was elicited. The laryngeal reflexes returned but the pharyngeal reflex was still absent. She recovered consciousness on 8th June, 1957 when she was first able to obey simple commands and answer simple questions.

During the time she was unconscious, her body temperature rose up to 102·6° F., and her chest became mildly infected with diminished air-entry over all areas and increase in moist sounds. This was treated with terramycin ¼ G. six-hourly. During this time also she was turned hourly, given intensive physiotherapy, and her trachea was *repeatedly sucked out*, was fed by a gastric tube and had Parenterovite I.V.

On discharge, tracheotomy wound had closed, no signs in chest, B.P.125/70, nystagmus was fairly marked on looking to the left and right, there was mild ataxia; no defect of co-ordination in arms or legs; there was good cerebration and she was well orientated in time and space. She was then transferred to another hospital for psychotherapy. Follow-up three months later showed her to have made a complete recovery and to have returned to normal life.

DISCUSSION



The structural formula of Megimide is shown above and resembles that of the barbiturate ring. The mode of action was first investigated by Shaw and others (1954). They made mice and rats unconscious with pentobarbitone (60 mg/kg.) and awakened them by intraperitoneal injection of megimide (100 mg/kg.).

In rabbits, alternate intravenous doses of thiopentone and Megimide produced a prolonged alternation of sleep and waking. These observations convinced Shaw that there was a specific antagonism between it and barbiturates. Further work has supported this view (Shaw 1955, Bentel, Barlow and Ginsberg 1956, Wyke and Frayworth 1957, Turner and Hodgetts 1956, Harris 1955) but other workers have concluded that it is a functional and not a competitive barbiturate antagonist (Hahn *et al* 1956, Bottiger *et al* 1957, Frey *et al* 1956). However, all the experimental work has confirmed the drug's stimulant effect on the central nervous system and in particular on respiration. Its probable site of action has been localized to the reticular activating mechanism of the brain stem and the neighbouring structures.

Although the amount of Megimide used in this case was small (200 mgm.), it was employed at critical stages when the clinical impression was that the patient would otherwise have succumbed. Treatment of shock, of respiratory obstruction and pulmonary complications, and the constant good nursing and supervision all contributed to the patient's recovery. Phenobarbitone was the usual agent causing prolonged coma in the previously reported cases and this is probably due to its slow elimination from the body.

SUMMARY

A case is reported of phenobarbitone poisoning with coma that lasted ten days. Megimide was found to be of value in therapy.

We would like to express our thanks to Dr. J. M. Naish for permission to publish this case.

REFERENCES

Bentel, H., Barlow, M. B. and Ginsberg, H. (1956). *Med. Proc.*, **2**, 198.
Bottiger, L. E., Engstedt, L. and Strandberg, O. (1957). *Lancet*, **1**, 932.
Frey, H. H., Hushahn, E. W. and Soehring, K. (1956). *Arzn. Fors.* **10**, 583.
Hahn, F., Oberdorf, A. and Schunk, R. (1956). *Deut. Med. Wochens.* **81**, 1580.
Harris, T. A. B. (1955). *Lancet*, **1**, 181.
Locket, S. (1956). *Proc. Roy. Soc. Med.* **49**, 585.
Lorraine, J. M. (1954). *Bull. Soc. Med. Hosp.* Paris, **70**, 511.
McElligott, M. (1955). *Lancet*, **1**, 820.
Med. J. of Australia. (1934). **1**, 505.
Shaw, F. H., Simon, S. E., Cass, N., Shulman, A., Anstree, J. R. and Nelson, E. B. (1954). *Nature.* **174**, 402.
Shulman, A., Shaw, F. H., Cass, N. M., Whyte, H. M. (1955). *Brit. Med. J.* **1**, 1238.
Turner, A. W. and Hodgetts, V. E. (1956). *Aus. Vet. J.* **32**, 49.
Wyke, B. D. and Frayworth, E. (1957). *Lancet*, **2**, 1025.

HERPES ZOSTER WITH CHICKEN-POX AND LYMPHOSARCOMA

A Clinical Pathological Conference of the University of Bristol Medical School on 20th May 1958.

CHAIRMAN: DR. O. C. LLOYD

Dr. Warin: This patient was an old man of 80, with no significant past history or family history.

On 26th July, 1957 he developed pain in the left side of the chest, followed by a rash on the upper part of the chest and one day later he developed a generalized rash which continued to erupt for two to three days. He was admitted to the Bristol Royal Infirmary. Examination showed typical herpes zoster with some gangrenous areas in the third and fourth thoracic dermatomes on the upper chest running round to the back; also a widespread eruption consisting of vesicles, many with haemorrhages into them, over the trunk, limbs, hands and feet. He was very ill, with a high temperature.

After two days he started to vomit, was restless and his abdomen was distended. Mr. Monks saw him and decided there was a subacute intestinal obstruction. He was, however, too ill for operation and we decided to watch and give intravenous fluids. After three days his general condition had improved and Mr. Monks operated and found an obstructed bowel. The patient died two days later.

There are one or two points I would like to mention, firstly the actual appearance of the rash was very like smallpox. He had vesicles characteristic of smallpox in type and distribution, and severe toxaemia. However I was reassured by the band on the left side of the chest—clearly a herpes zoster.

The viruses of herpes zoster and of chicken-pox are closely related and there is no doubt that contacts of herpes zoster may develop chicken-pox. This was demonstrated in this case by the fact that our Registrar developed chicken-pox two weeks after this patient was admitted, and had a very severe, haemorrhagic eruption. Our ward staff nurse had not had chicken-pox and she informed us that she was three months pregnant—what should we do? I rang up Professor Perry who decided that the best thing was to give her gamma globulin. I would like to know whether you think there is a real risk of chicken-pox in early pregnancy and whether gamma globulin would prevent it.

The other point I want to make is that a few aberrant vesicles in cases of herpes zoster are quite common, but this very widespread rash with herpes zoster is rare and there is usually some underlying debilitating state when it does occur. Dr. Mark Hewitt (1954) recorded four cases in our own *Journal*, and of these one had Hodgkin's disease and another carcinoma.

Plates VII, VIII and IX show the patient from the back, front and side views.

Mr. Monks: Dr. Warin asked me to see this man on the 2nd August, two days after admission, because he was vomiting and his abdomen was distended. When we examined him he was dehydrated, his abdomen was grossly distended and we could feel loops of bowel, and could actually feel them contracting. He also had loud and tinkling bowel sounds. It was difficult to decide whether the man had colic or not, he was rather disorientated.

Operative treatment was unjustified at this stage; we did not know what was the cause of this obstruction. He was therefore given an enema and passed a considerable amount of flatus. He had a nasal tube and we aspirated moderate amounts of small bowel contents. We continued in this manner, giving frequent enemas, sucks out, and an intravenous drip until the 6th August. By this time though the abdomen was

becoming progressively more distended he was maintaining his general condition fairly well, and if anything it had improved; and by the 6th August we felt that this old man was grimly holding on to life. We had in mind the possibility of an underlying malignant disease, probably carcinoma of the colon, and thought that we should do a colostomy.

On the 6th August we opened the abdomen and found he had a grossly distended small and large bowel and there was serous fluid in the peritoneal cavity; in his mesentery there were some very large discrete glands (up to about 2 in. diameter). We could find no definite point of obstruction of the bowel so we deflated it, and closed the abdomen. We thought it was some kind of lymphosarcoma or other tumour causing ileus by interfering with the innervation of the bowel.

Following this he went gradually downhill and died about 48 hours later.

Dr. Doyle showed X-Ray photographs: Plate X is an antero-posterior film with the patient lying supine; there is moderate distension in numerous small bowel loops, but with considerable air and faecal content in the ascending, transverse and descending colon. The films did not show the whole of the bowel but we suggested it was most likely to be an ileus.

Dr. McConnell: What is the significance of increased bowel sounds?

Mr. Monks: The bowel sounds are a sign to be taken into consideration, when you have distension. With bowel sounds loud and tinkling there is more likelihood of it being obstruction than ileus.

Dr. Lloyd: In what circumstances do you get complete absence of bowel sounds?

Mr. Monks: It depends how long you listen. It is necessary to listen for quite some time. Perforated duodenal ulcers are characterized by absent bowel sounds when you see them fairly early. After a time the sounds return. In an internal strangulation which is the most severe form of intestinal obstruction, there may be no sounds if the obstruction is very high. When bowel sounds are absent post-operatively it helps to distinguish between peritonitis and post operative obstruction due for instance to a bit of bowel caught into a hole in the mesentery. The presence or absence of bowel sounds is useful at times to distinguish between the two. During the war this was a useful sign of intra-abdominal injury.

Dr. Lloyd: Would it be true to say that the presence of bowel sounds means that surgical interference is more likely to be effective than it would be in the absence of sounds?

Mr. Monks: In this type of case, yes. They indicate that there is gas and fluid in the small bowel and the small bowel is contracting. This must be taken into consideration with the other findings.

Question: How is it possible completely to exclude smallpox in a case like this?

Dr. Warin: In this case it was easy because of the area of herpes zoster and the pain and the mode of onset. But of course there is a very real difficulty in differentiating between a chicken-pox and a smallpox, particularly a smallpox modified by vaccination, and I think it can at times be impossible. The rash of smallpox is more marked on the extremities and shotty vesicles and pustules occur on the palms and soles. There is quite a lot made of whether the vesicles are unilocular or multiocular but I do not think it very important. The virus of smallpox can be demonstrated with a fair degree of certainty by a direct smear of the vesicular fluid.

Question: Were there any vesicles on the mucous membrane?

Dr. Warin: Yes, they were to be seen in the buccal mucosa.

Dr. Lloyd: The rash in this case was worst on the trunk, but would it not be true to say that generally speaking his hands had been free?

Dr. Warin: No. He had quite a lot on his hands and feet, maybe they had faded when you saw him, but he had these typical shotty vesicles that one could demonstrate quite easily.

Question: Can they be seen in the bladder in herpes zoster?

Dr. Warin: I do not know of any report.

Dr. Lloyd: I think at this stage it would be a good thing for me to tell you about the post mortem findings:

The body was slightly wasted and there was still some distension of the abdomen. The rash was as has been described to you already, both the haemorrhagic chicken-pox rash and also the confluent zoster rash, particularly in the distribution of the third left thoracic dermatome. This was very much infected posteriorly so that there was a great deal of pus being formed. I think the secondary infection accounted a great deal for the toxic symptoms from which he was suffering. There was a little fibrinous peritonitis, particularly in the lower half of the abdomen, but it was not a very pronounced finding.

The myocardium showed some scattered areas of fibrosis but this was not particularly significant. There was hypostatic compression collapse of the lungs affecting particularly the right lower lobe, where there was acute bronchiolitis. The spleen was greatly enlarged, rather soft and adherent to the diaphragm. The lymph nodes showed moderate enlargement of all groups with the exception of the mediastinal, paratracheal and inguinal nodes. The enlargement was greatest in the case of mesenteric nodes. The left subclavian nodes were much larger than the right, possibly because of the suppurating zoster rash. The stomach was severely dilated and the mucosa dotted all over with small acute erosions. The small intestine was greatly dilated (up to 12 cm. circumference, but in the terminal ileum only 8 cm. circumference). There was a polypoid submucosal lipoma (2 cm. diameter) at the junction of the jejunum and ileum but it was not causing obstruction. The colon was only moderately dilated. There was evidence of the small intestine having been opened and neatly sewn up again in the manner which has been described. The prostate had been partly removed at a previous operation; there was slight nodular enlargement of the right lobe, not causing any obstruction.

Dr. Lloyd then showed some coloured slides, which are here reproduced in monochrome.

Slide *a* (Plate XI) shows mesenteric lymph nodes and some in the neighbourhood of the pancreas; they are greatly enlarged. The largest one has been cut across and you can see that there are little spots of haemorrhage and yellowish areas of necrosis. That turned out to be a lymphosarcoma and all other nodes sectioned showed evidence of the same disease, which is a systematized lymphosarcomatosis.

Slide *b* (Plate XII) shows the distribution of lymphocytes in portal areas of the liver, characteristic of lymphosarcoma and also seen in lymphatic leukaemia.

Slide *c* (Plate XIII) shows the spinal cord with the posterior root ganglia dissected out on the left side of the body. The third left dorsal root ganglion is red, having undergone haemorrhagic infarction one, of the changes one sometimes sees in severe cases of herpes zoster. There was thrombosis of distended vessels in the posterior root and you can see that there is intense congestion of the dorsal horns in the transverse section of the spinal cord. This could be traced for several centimeters above the third root.

Slide *d* (Plate XIV) shows a transverse section of the third left posterior root. Thrombus distends the blood vessels and there is interstitial haemorrhage.

Slide *e* (Plate XV) this intense cuffing of the blood vessels in the posterior roots of the spinal cord was found on the left hand side, only; which is the side of the body affected by the zoster inflammation. This is caused by the products of inflammation going to the spinal cord by way of the blood vessels of the left third dorsal root, and so into the posterior horn.

Slide *f* (Plate XVI) shows a section of the second left posterior root ganglion which is more or less normal. You can compare it with Slide *g* (Plate XVII) the third. Here there is complete haemorrhagic necrosis of all the cells. The nuclei both of the ganglion cells and of their satellite cells have disappeared and I was unable to demonstrate any intranuclear inclusion bodies. In cases of zoster one expects to find these bodies fairly frequently in the satellite cells and rather rarely in the nuclei of the

PLATE VII

Herpes zoster and varicella (front).

PLATE VIII

Herpes zoster and varicella (back).

[*Face page 24*

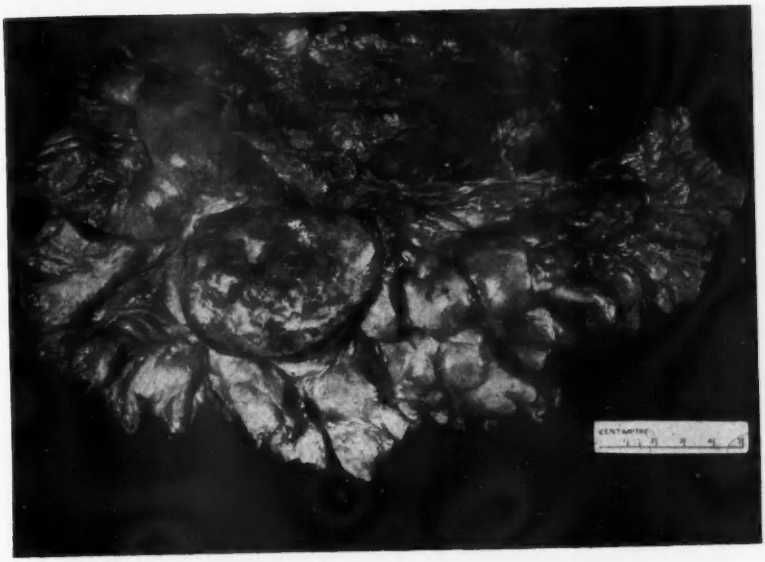
PLATE IX

Herpes zoster and varicella (side).

PLATE X

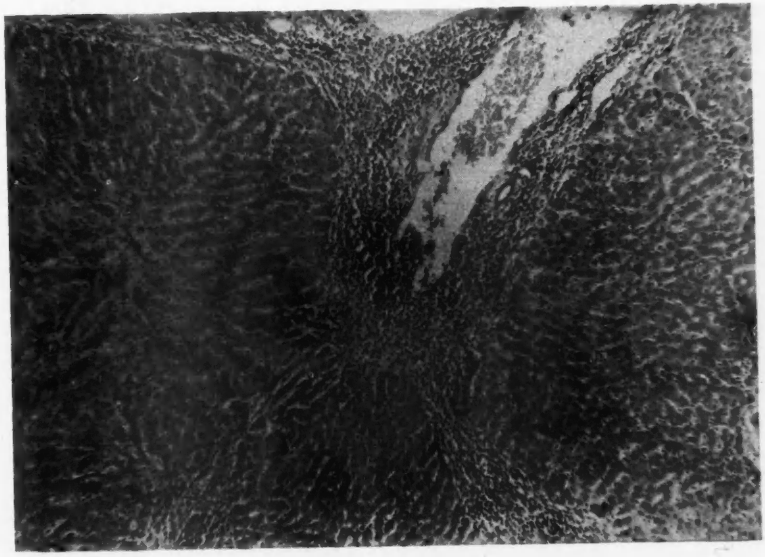
X-ray of abdomen; distension of small bowel loops due to ileus.

PLATE XI



Mesenteric lymph nodes: lymphosarcoma.

PLATE XII



Liver: portal lymphocytosis due to lymphosarcoma (× 150).

PLATE XIII

Spinal cord; herpes zoster; haemorrhagic infarction of dorsal root ganglion of T.3 left.

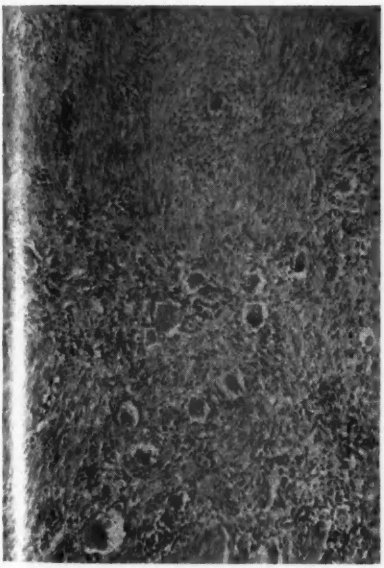
PLATE XIV

T.S. T.3. left posterior root; thrombosis and haemorrhage (× 150).

PLATE XV

Spinal cord, posterior horn of T.3. left. Lymphocytic cuffing of vessels (× 150).

PLATE XVI



T.2. left posterior root ganglion; normal (× 150).

PLATE XVII

T.3. left posterior root ganglion; haemorrhagic infarction due to zoster (× 150).

[*Face plate XIII*

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ganglion cells. Inclusion bodies may be found in the cells of a variety of different organs in chicken-pox: skin vesicles, liver, lung and other places as well. In one of these ganglion cells I found a hyaline body surrounded by a clear halo that might have done for an inclusion body, but it wasn't right. The halo around the inclusion bodies should be within the nuclear membrane, and here there is so much necrosis that none of the nuclear membranes survive.

I was disappointed in not finding inclusion bodies in the skin in this case. This may have been due to technical troubles, or it may have been because the disease was already in a rather late stage.

In searching for these lesions I was going very much by the descriptions of cases of chicken-pox by Cheatham et al. (1956). One of their cases had zoster as well as chicken-pox and in that case they demonstrated inclusion bodies commonly in the satellite cells but rarely in the ganglion cells. One of their cases was a child with a neuroblastoma, and these diligent people searched through the neuroblastoma cells to find if it also was suffering from chicken-pox and they found that it was.

To sum up, this is the case of a man with lymphosarcoma who developed chicken-pox and herpes zoster, he went on to develop signs of intestinal obstruction and Mr. Monks was able to find a severely dilated intestine and let that down, but there was no actual mechanical obstruction. It was probably due to interference with the neuro-muscular mechanism of the bowel by the presence of the tumour he found. I do not know how this works but I think he will tell us that it does happen in a number of cases of paralytic ileus.

Question: Could you tell us if there were any vesicles in the lungs? I believe it does occur in advanced cases of chicken-pox.

Dr. Lloyd: No, I did not find any. Inclusion bodies in the lung tissue have been described.

Dr. Cayton: May I reinforce what Dr. Warin said about the importance of excluding smallpox where any suspicion may arise. I would like to draw your attention to the account of an epidemic of smallpox in Tottenham in 1957 (Hogben et al. 1958) in which a child, the grandson of a laboratory cleaner, dying of smallpox, led to the recognition of the real cause of the grandmother's ill health, and to the ultimate recognition of an undiagnosed fatal case of haemorrhagic smallpox which came to necropsy as "acute leukaemia". Laboratory confirmation of the disease can usually be obtained within 18 hours of the receipt of the specimen. In smallpox relatively large inclusion bodies can be seen in smears of fluid from the vesicles. I would urge that these cases are not the obvious ones and it is much better to ask for advice and get bacteriology or virology done rather than be wise after the event.

Another point: that of gamma globulin in contacts in the early stages of pregnancy. There is no direct evidence as far as I know that chicken-pox is likely to affect the foetus. Gamma globulin is very expensive and is normally only available for immediate contacts of german measles. We have had quite a lot now, three or four rubella contacts every week for the last ten to fifteen weeks, and an analysis of 1700 contacts showed an attack rate of 3 per cent in those protected. When rubella is diagnosed it is then a question of whether or not pregnancy should be terminated.

Professor Neale: In long past years, when liquor arsenicalis was used medically more often for all sorts of disorders, it was noted that herpes zoster seemed to be precipitated by the drug. Arsenic as such is now very rarely used, but recently a new factor has been introduced. I refer to cortisone. If a person on cortisone treatment for something else gets chicken-pox the virus might take on exceptional invasive action in various tissues, especially the brain, liver, lung and heart muscle, with necrotizing effects and fatal cases have been reported. (Nicholas 1957, Haggerty & Eley 1956, B.M.J. 1957, Good et al. 1957). It is simply an example that medicinal cortisone can break down the normal reactions and resistance of the individual to the virus. In fact, it may predispose the patient to a generalized spread of the virus disease and a fulminating course.

You said that the rash was "the same as smallpox". I know you did not mean it, but how did you come to the conclusion, at the bedside in five minutes, that it was not smallpox?

Dr. Warin: I do not think I said "the same as smallpox". However, judged by the rash alone the actual vesicles in this patient would have been pretty well impossible to tell apart from smallpox, but diagnosis was easy because of the history, because of the big patch running round the side of the chest and because of the pain on onset. But looking at one particular patch of the eruption I think it would have been impossible.

Dr. Lloyd said that the enlarged lymph nodes in the left axilla were due to secondary infection. I think we might remind ourselves that you get quite marked lymph node enlargement with herpes zoster and with herpes simplex, uncomplicated by secondary infection.

Dr. Cayton: In the missed case reported the primary cause of death was assumed to be acute leukaemia and it is these acutely ill patients with haemorrhagic rashes which may be confused with smallpox.

Professor Neale: What is the nature of the lesion usually to be found in the posterior root ganglion in cases of herpes zoster?

Dr. Lloyd: Usually there is a lymphocytic infiltration with congestion and oedema. Inclusion bodies are to be found in satellite cells. But in quite a number of cases the ganglion does undergo haemorrhagic necrosis and that was so in this case.

Professor Neale: Do you think it might be related to the post-herpetic neuralgia?

Dr. Lloyd: I would not be surprised. Perhaps Dr. Norman could tell us?

Dr. Norman: I have never heard of any connection between the two.

REFERENCES

Annotation (1957), "Dangers of chicken-pox", *Brit. Med. Jour.*, 1957, i: 511–2.

Cheatham, W. J., Weller, T. H., Dolan, T. F. and Dower, J. C. (1956) "Varicella: report of two fatal cases with necropsy, virus isolation and serologic studies," *Am. J. Path.*, **32**: 1015–1053.

Good, R. A., Vermier, R. L. and Smith, R. T. (1957), "Serious untoward reactions to therapy with cortisone and adrenocorticotropin in pediatric practice", *Pediatrics*, **19**: 95–118 and 272–84.

Haggerty, R. J. and Eley, R. C. (1956), "Varicella and Cortisone", *Pediatrics*, **18**: 160–162.

Hewitt, M. (1954), "Herpes zoster generalisatus", *Med. Jour. of the South West*,, **70**: 57–60.

Hogben, G. H., McKendrick, G. D. W. and Nicol, C. G. (1958), "Smallpox in Tottenham—1957", *The Lancet*, i : 1061–4 (17th May).

Nicholas, W. W. (1957), "Experiences with chicken-pox in patients receiving cortisone." *Amer. J. Dis. Child.*, **94** : 219.

Notes and News

OBITUARY

A. T. Todd.

WEST OF ENGLAND CHILD HEALTH GROUP

Secretary: Dr. P. G. Roads, Central Health Clinic, Tower Hill, Bristol 2.

Details of the May and June meetings are as follows:

5th May, at 5.30 p.m., at the Children's Hospital: Miss Cecile Hopkins, M.R.C.S., L.R.C.P., D.P.H., **"Problem Families".**

25th June, at 6 p.m., at Manor Hall, Clifton: Mrs. Marjorie Tait, B.A., PH.D., **"The Care of Young Ladies".**

EXAMINATION RESULT

M.D. (*Aberdeen*): R. S. Crow (with commendation).

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Lassey, H. S.
Mapstone, R.
McClements, B. R. S.
Ogden, A. H.
Parker, R. K. H.
Power, P. C.
Shield, J. E. H.
Shute, G. S.
Simon, A. P.
Webster, L. F.

PRIZES

British Dental Association Prize in Dental Anatomy: D. Hill.
George Fawn Prize: I. M. Vickery.

Appointments

E. W. Bradford, D.D.SC., senior lecturer in preventive dentistry and parodontal diseases at St. Andrews, has been appointed to the chair of dental surgery in the University of Bristol. Professor A. I. Darling will assume the title of "professor of dental medicine".

K. W. Aron, M.B. (Bristol), D.P.M., consultant child psychiatrist to develop child guidance services, Glamorgan.

W. Ross Ashby, M.A., M.D., director of research at Barnwood House, Gloucester, has been appointed director of the Burden Neurological Institute, Bristol, in succession to Professor F. L. Golla, who is retiring.

Dorothy M. Boisen, M.B. (Bristol), medical officer, School Health Service, Birmingham.

P. O. Nicholas, M.B. (Bristol), D.C.H., Assistant M.O. and School M.O., Castleford, Yorkshire.

P. R. H. Slade, CH.M. (Bristol), F.R.C.S., senior registrar in thoracic surgery, Papworth Hospital.

UNITED BRISTOL HOSPITALS

SEPTEMBER TO NOVEMBER, 1958

Name	*Appointment*	*Formerly*
RAPER, A. B., B.SC., M.D., M.R.C.P., D.T.M. & H.	Consultant Pathologist (specializing in Haematology).	Member of the senior Scientific Staff, National Institute of Medical Research and previously Senior Pathologist, Uganda Medical Service.

Name	*Appointment*	*Formerly*
DAVIS, R. REED, F.R.C.S., F.R.C.S.E.	Registrar in Orthopaedics.	Chief Assistant to Clinical Director, Birmingham Accident Hospital.
MARTYN, SHEILA A., M.B., CH.B., (B'tol.), M.R.C.O.G.	Registrar in Obstetrics and Gynaecology.	Locum Registrar, Southmead Hospital (formerly Temporary Lecturer, University of Leeds).
BURNS, D. M. J., M.B., B.CHIR., (Camb.), M.R.C.S., L.R.C.P.	Registrar in Ophthalmology.	S.H.O., General Surgery, Newcastle General Hospital.
MAYO, K. M., M.B., CH.B., D.M.R.D.	Registrar in Radiology (Diagnostic).	Research Assistant.
HOUGHTON, E. A. W., M.B., CH.B. (B'tol.), D.M.R.D.	Registrar in Radiology (Diagnostic).	Part-time Registrar in Radiodiagnosis., U.B.H.
WILLIAMS, D. P. C., M.B., CH.B. (L'pool), D.L.O.	Registrar in Ear, Nose and Throat Surgery.	Civilian Ear, Nose and Throat Specialist of Central Medical Establishment, R.A.F.
PHILPOTT, B., M.B., B.S., (Lond.), L.R.C.P., M.R.C.S., D.A.	Registrar in Anaesthetics.	S.H.O. in Anaesthetics, Charing Cross Hospital.
JENKINS, D. G., F.R.C.S.	Locum tenens Senior Registrar in Genito-Urinary Surgery.	—

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HANKS, G. A., M.B., CH.B. (B'tol.), D.R.C.O.G.	Surgical Registrar, Weston-super-Mare General Hospital.	S.H.O. in General Surgery, B.R.I.
TALWAR, D. R., M.B., B.S., D.A. (Bombay).	Anaesthetic Registrar, Southmead Hospital, Bristol.	Anaesthetic Registrar, Derbyshire Royal Infirmary.

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CROUCH, H. E., M.B., B.CH., B.A.O. (Belfast).	Clinical Assistant in Dermatology, Stroud Hospital and Gloucester Royal Hospital, Gloucester.	—
MCCARTHY, T. F., B.SC., M.D. (Wales), M.R.C.P. (Edin.).	Assistant Geriatrician, North Gloucestershire Clinical Area.	Resident Physician, Nab Top Sanatorium, Marple.
SHEPHARD, G. D. H., M.B., B.CHIR. (CANTAB). D.OBST., R.C.O.G.	G.P. Surgeon, Tewkesbury Hospital.	Is in general practice in Tewkesbury.

BATH

Name	*Appointment*	*Formerly*
VAN DEN BRUL, P. J., M.B., B.S. (LOND.).	Anaesthetic Registrar, Bath Group of Hospitals.	Resident Anaesthetist, R.U.H., Bath.
STEWART, D. J., M.B., CH.B. (GLASGOW).	Re-appointed for further year as Clinical Assistant in Orthopaedic & Traumatic Surgery, R.U.H., Bath.	Is in general practice in Bath.
WATERS, M. A., M.B., B.S. (LOND.), M.R.C.P. (EDIN.), D.P.M. (CONJOINT).	Consultant Psychiatrist, Roundway Hospital, Devizes.	Assistant Psychiatrist, Horton Hospital, Epsom.

SOUTH SOMERSET

Name	*Appointment*	*Formerly*
WEBB, B. W., M.D. (LOND.), M.R.C.P. (LOND.), D.C.H. (ENG.).	Consultant Paediatrician, South Somerset Clinical Area.	Senior Registrar, Children's Department, King's College Hospital & Belgrave Hospital for Children.
ISAAC, D. H., M.D. (LOND.), M.R.C.P. (LOND.).	Consultant Physician, South Somerset Clinical Area.	Senior Medical Registrar, U.B.H.

DEVON AND CORNWALL

Name	*Appointment*	*Formerly*
MCCORMICK, A. J. A., M.B., CH.B. (ED.), F.R.C.S. (ED.), D.O.M.S.	Ophthalmologist, Exeter Clinical Area (Torquay).	Senior Registrar in Ophthalmology, U.B.H.
ELLIS, D. D., M.B., B.CH., B.A.O. (BELFAST), D.P.M. (R.C.P.S.I.).	Consultant Psychiatrist, St. Lawrence's Hospital, Bodmin.	Assistant Psychiatrist, Winwick Hospital Warrington.
STIRK, D. I., F.R.C.S. (ENG.).	Consultant Surgeon, Exeter Clinical Area (North Devon Infirmary, Barnstaple).	Senior Surgical Registrar, Singapore General Hospital.
GARDNER, A. M. N., B.M., B.CH. (OXON.), F.R.C.S. (ENG.).	Consultant Surgeon, Exeter Clinical Area (Torquay).	Senior Surgical Registrar, Radcliffe Infirmary, Oxford & Northampton General Hpl.
WALKER, H. M., M.B., B.S. (MELBOURNE).	Registrar in Obstetrics & Gynae., Royal Devon & Exeter Hospital (appt. with Southmead Hospital).	S.H.O. in Obstetrics & Gynae. (joint St. James's Hospital, Balham).
NEWTON, A. J., M.B., B.S. (LOND.).	Registrar in Orthopaedic and Traumatic Surgery to work at Torbay Hospital, Torquay and Princess Elizabeth Orthopaedic Hospital, Exeter, on an exchange basis.	Locum S.H.O. to Fracture & Accident Department, Gloucestershire Royal Hospital, Gloucester.
PARKES, J., M.A., M.B., B.CHIR. (CANTAB.), M.R.C.P. (EDIN.).	Re-appointed for further year as Clinical Assistant in Paediatrics, Torquay,	Is in general practice in Torquay.
WILLIAMSON, F., M.D. (TORONTO).	Surgical Registrar, Torbay Hospital, Torquay and Newton Abbot Hospital.	Locum Surgical Registrar, Maidenhead General Hospital.
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